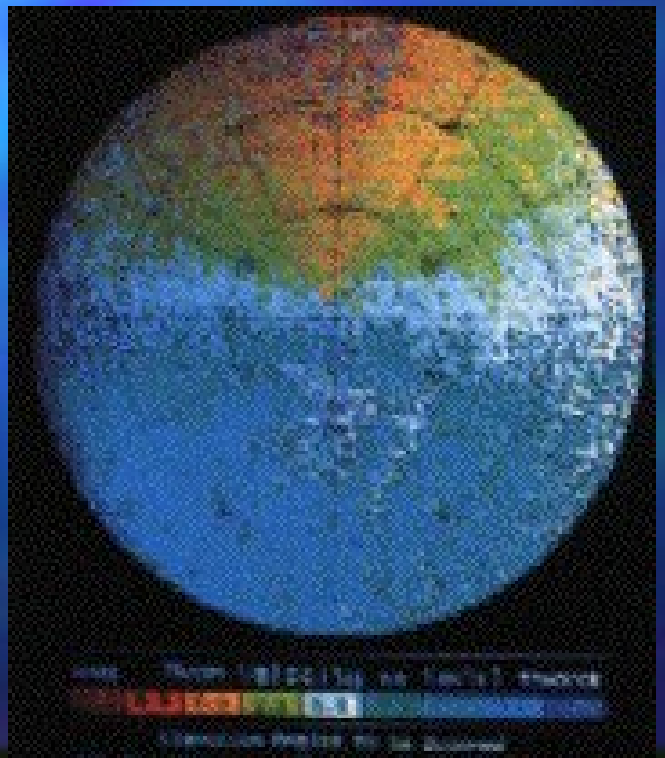
Doppler Radar

NEMOC Training Department



History

- 1960’s - National Weather Service began testing at National Severe Storms Lab in OK
- Late 1970’s, Enterprise Electronics Corp fitted one of their radars with Doppler capability
- 1982 - National Weather Service adapted this version to their 74C radar (used until 1993)

Doppler radar

- Developed to better detect tornado producing storms.
- Can detect areas of precipitation and measure speed of falling precipitation.
- Measures the speed at which precipitation is moving horizontally toward or away from the radar antenna.

How does Doppler work?

- As precipitation moves toward or away from the antenna, the returning radar pulse will change frequency.
- Change in frequency = Doppler Shift
- By knowing the amplitude and the sign of the frequency shifts, direction and wind speed can be determined.
- Known as Velocity Data

Weather radar

- Measures power back scattered from precipitation and other targets
- Known as Intensity Data
- Can be in the form of power return in dB or rainfall rates

NEXRAD = WSR - 88D

- The latest and newest of the Doppler radars, uses Doppler and weather radar data
- Fully automated, scanning methods and radar settings entered by operator
- Improvements:
  - Measures Doppler shift of returned signal to measure precipitation movement as well as reflectivity
  - Completely digital -> more products can be produced form the radar echo data

Measurement and Displays

- Radar Data Acquisition (RDA) Processor
  - Antenna, Transmitter, Receiver
  - Computer Equipment -> controls the radar, sweeps for the volume scans and acquires 3D data
- Radar Product Generation (RPG)
  - Generates products by applying computer programs to the raw data
- Principle User Processor (PUP)
  - Workstations where data is requested and products are displayed

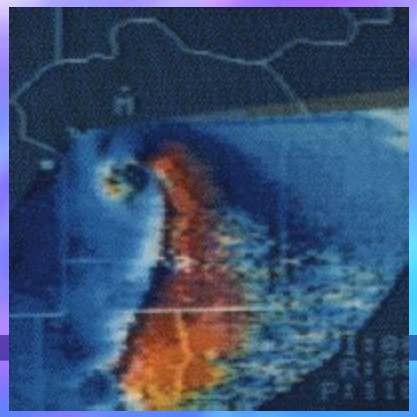
How does NEXRAD work?

- Radar Antenna scans in 360 degree azimuth sweeps at various elevation angles for 3D view
- A complete set of multiple elevation scans is a volume scan (Available every 5 to 10 minutes)
- Ranges:

WEATHER TYPE	NOMINAL Rmax KM Computed	EXPERIENCE Rmax KM NOMINAL	MONTGOMERY* WSR-74C
Tornado Vortex Sig.	30	35 [10-70]	46 [U-80]
Misocyclone	60	35 [10-70]	No Data
Super Cell Mesocyclone	230	180 [150-230]	60 [U-200]
Mini Super Cell Mesocyclone	120	100 [70-120]	No Data
Hook Echo Super Cell	126	100 [40-160]	63 [U-120]
Hook Echo Mini Super Cell	77	60 [30-80]	No Data
Microburst	45	35 [25-50]	No Data
Macroburst	77	70 [50-100]	No Data
High Surface Winds	103	70 [20-120]	66 [U-140]

Advantages

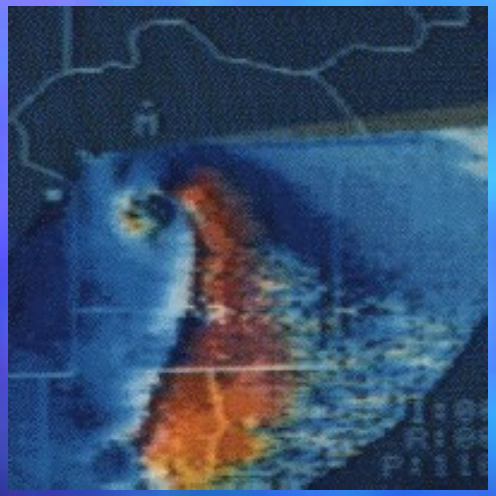
- Allows operators to look inside the storm and see the structure of intensity and wind
- Assists forecasters in determining which severe storm will likely spawn a tornado
- Advanced and improved warning of approaching tornadoes
- Help identify the magnitude of other severe weather phenomena
- Aviation safety, wind shear and microburst detection



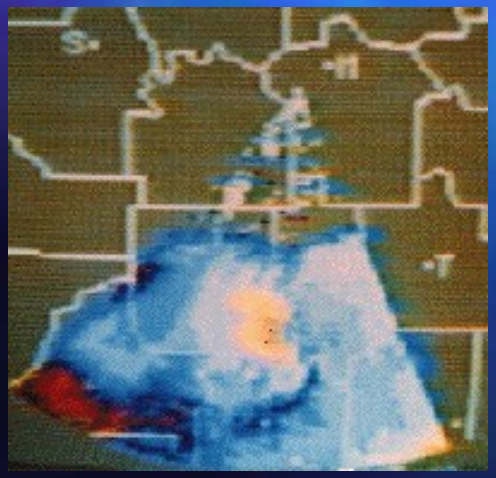
Tornadoes

- Shows as a region of rapidly changing wind speeds within the mesocyclone
- Distinct signature -> Tornado Vortex Signature (TVS)
- When this feature is present tornadoes are forming
- Smaller portable Doppler units are obtaining tornado wind information at close ranges

Examples



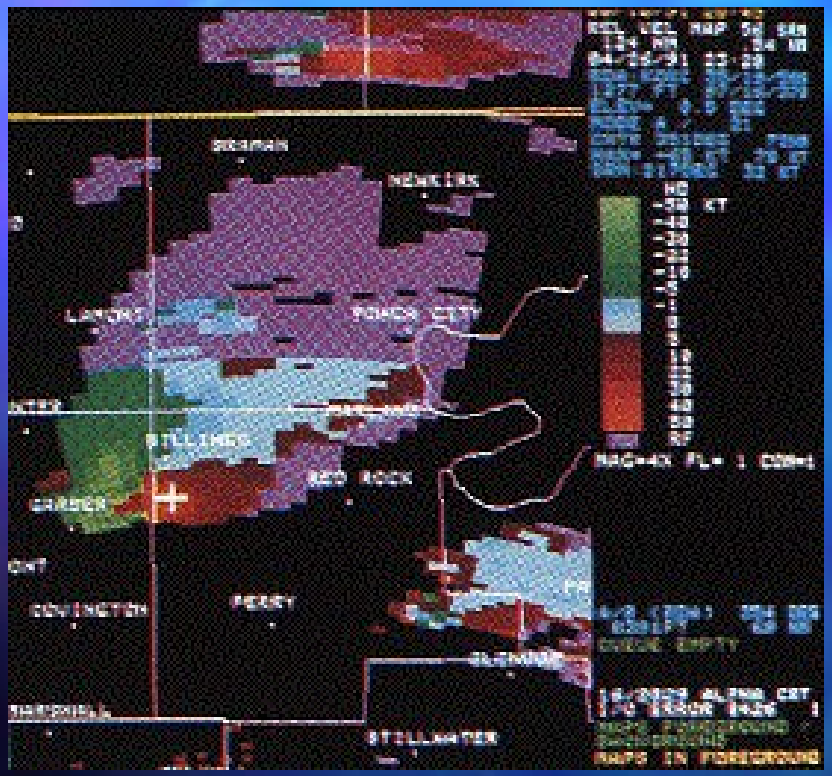
Shows tornado vortex signature just SE o



Mesocyclone.

Blue colors are winds towards the radar and reds and yellows are away from the radar.

Examples



Strong mesocyclone over northern Oklahoma.

Red colors are winds away from the radar and green colors are towards the radar. Purple colors are ambiguous velocities.

There is a 100 knot shear from the red to the greens at the bottom portion of the storm. About the time this velocity data was taken a tornado was occurring near the strong

Questions

1. T/F Weather radar and Doppler radar measure the same data.

False. Weather radar measures Intensity Data.

Doppler measures the Doppler Shift, which is Velocity Data.

2. Where are products displayed with the NEXRAD?

On the Principle User Processor (PUP).